STEM Activity 1:
Phone book friction

Background information and Science information

Friction is the resistance that one surface or object encounters when moving over another. The concept behind this experiment: the friction that each page exerts on the touching page from the other book should cause them to stick together. As each page exerts a force of friction on the touching page, the more pages you have interlaced, the harder it should be to separate the books.

Take photos at key points during the activity. You can use these later for activities such as sequencing, recalling and improving vocabulary.

Friction:
How Strong is Friction?

ACTIVITY 1

Method

Introduction

Discuss friction with the learners, using these key words:

Slip Slide Move Stick

Push Pull Slow down

Rub Heat Rough Smooth

Ask the learners to rub their hands together quickly. Ask them to notice how their hands get warmer.

Examine velcro. How easy is it to pull apart? Why do we use this in clothing? Examine other fastenings such as zips and press studs. Why do we need them to be difficult to pull apart?

Examine plastic trays. Learners should slide their hands over the surfaces. How easily can they move over the surface? Add a little washing-up liquid to the surface of the tray. Slide hands over the surface again. Do they move more easily than before? Encourage learners to use descriptive words.

Development

The Books Experiment

1. Start by showing learners how easy it is to separate two books if they are simply halved and placed inside each other with just two pages overlapping.
2. Interlace 10 pages of the book by placing one page from each book over the top of a page from the other book. The two books should now interlock with the spines of the books facing out either side.
3. Ask learners to get into pairs. Ask one person to hold the spine of one book and the other partner to hold the spine of the other book. On a signal from you, each partner can pull in the spine of their book to see if they can separate them.
4. Repeat this process increasing the number of pages interlaced with each other. Encourage the learners to talk about what is happening. Does it get easier or harder to separate the books?

Scientific Inquiry

How strong can friction be?

Learning Intention

Friction can be stronger than me.

Equipment

- Velcro
- Zips
- Press studs
- Plastic trays
- Washing-up liquid
- Two phone books or two similarly-sized books with 100 plus pages and soft covers

Safety

Be aware of your positioning when attempting to pull the books apart, so that you do not fall backwards.

Discussion

Strong friction can be useful. It helps to fasten our clothes. It helps to stop us slipping when we have a good gripping surface on our shoes. When else might strong friction be useful? (For example, placemats to stop plates slipping on a table.)

N.B: In these lessons we only discuss friction. If you wish, you may also discuss how to lessen friction by use of lubrication, for example using oil in machinery.

Extension

Ask the class: 'What is the least number of pages that you need to overlap to create a sticking sensation?'

Will different patterns in the page overlapping make a difference if it is:

- pages all at the front of the books; or
- all at the back of the book; or
- only in the middle; or
- if they are spaced out throughout the books?

Examine shoes. Which ones will give the most friction? Why do dancers often use shoes with very smooth soles?

STEM Activity 2:
Air friction

Background information and Science information

Air friction, otherwise referred to as air resistance or drag, is a type of fluid friction. A larger surface area will create more air friction.

Take photos at key points during the activity. You can use these later for activities such as sequencing, recalling and improving vocabulary.

Friction:
How Does Air Affect Falling Objects?

ACTIVITY 2

Method

Introduction

Discuss the idea of 'bigger' and 'smaller'.

Compare objects and agree which is biggest and which is smallest.

Discuss how to make some objects smaller. For example, we can crush an empty drink can to make it smaller.

Talk with the learners about air:

- What is air?
- How do we know it is there? (We can feel it, for example wind, blowing, or a fan.)
- What does air do? (We breathe it.)
- Does air do anything else?

Development

1. Examine two same-sized sheets of paper.
2. Take one sheet of paper and scrunch it into a ball.
3. Keep a second sheet of paper flat.
4. Hold both pieces of paper at the same height. Talk about air being between the paper and the ground. Encourage learners to talk about what effect the air might have when the pages are falling.
5. Release both pieces of paper at the same time from the same height.
6. Record this on an iPad.
7. Observe to see if one lands faster than the other one.
8. Repeat with a different set of paper.

Watch the videos. (It may be useful to watch in slow motion).

- Which lands first: the flat page or the balled page?
- Is this the same every time?

Scientific Inquiry

Can air create friction?

Learning Intention

Air will slow things down more if they have a larger surface area.

Equipment

- Classroom objects to compare for 'bigger' and 'smaller'
- Objects which can be crushed or scrunched up to give a smaller surface area (to 'make smaller')
- Sets of two same-sized sheets of paper (the sizes of pages should vary from tiny to as big as possible)
- Digital tablet for video and/or timer

Friction:
How Does Air Affect Falling Objects?

ACTIVITY 2

Discussion

Key questions:

- Which is bigger, the balled paper or the flat paper?
- Which piece of paper landed first?
- Talk about how the air was between the paper and the ground.
- Did the air have different effects on the balled paper and the flat paper?
- Was there friction when the paper travelled through the air?

Extension

Alternative investigations:

- Does the height you drop the paper from affect the result of which one lands first?
- Does the shape of the crunched paper affect the result? Can you make a shape that is faster?

STEM Activity 3:
What slides fastest?

Background information and Science information

Sliding friction is the resistance created by two objects sliding against each other. This can also be called kinetic friction. Sliding friction is intended to stop an object from moving.

Take photos at key points during the activity. You can use these later for activities such as sequencing, recalling and improving vocabulary.

Friction:
Sliding Friction

ACTIVITY 3

Method

Introduction

Talk about friction using the key words from STEM Activity 1.

Examine the objects for testing. Sort objects into 'rough' and 'smooth'.

Development

1. Take your selection of objects to be tested out to the playground slide, or if one is not available, make a suitable ramp sloping from a chair height to the ground.
2. Put each individual item at the top of the slide and allow it to move freely down the slide on its own: do not push it along.
3. Mark and measure how far it travelled. Record the distance.

Discussion

Sort the objects by the distance travelled.

Ask the learners: 'Which objects went furthest?'

Do objects with a rough or smooth surface travel furthest?

When a person uses the slide, which type of clothes help them to go faster?

Do trainers or shoes slow a person down?

Extension

Wet the slide. Ask the learners:

- 'How does this impact the distance the items travel?'
- 'Has the water reduced or increased the amount of friction?'

Scientific Inquiry

Do all objects slide at the same speed?

Learning Intention

Different objects and materials slide at different speeds due to the amount of friction they produce.

Equipment

- Slide or ramp
- Items to be tested, such as shoe, ball, book, toy vehicle and so on. (Think about weights, materials and types of objects when you are selecting them. For example, objects with a silky or smooth finish will slide faster than objects with a rough or rubbery finish. Be aware that heavier objects may travel further due to weight).
- Chalk
- Measuring tape
- Water (for extension activity)

STEM Activity 4:
Rough and smooth surfaces

Background information and Science information

Static friction occurs when an object isn't moving. It will take an amount of force to get the object moving.

This activity is more difficult than the previous ones. It may not be suitable for all classes.

Take photos at key points during the activity. These can be used later for activities such as sequencing, recalling and improving vocabulary.

Friction:
Static Friction

ACTIVITY 4

Method

Introduction

Talk about friction and look at the pictures and videos from previous lessons.

What effect does friction have when we try to move objects?

Look at the surfaces to be tested. Discuss which are rough and which are smooth.

Development

1. Cut the rubber band in half.
2. Tie one end to the box or basket selected for the testing.
3. Take your selection of surfaces to be tested out to the playground or other suitable area.
4. Place the box or basket on the first surface to be tested. You may need to place a small weight in the box or basket to keep it grounded.
5. Place the tape measure or ruler at the side of the box or basket with one end level with the back of the box or basket.
6. Pull the elastic band on the end not attached to the box or basket until it begins to move.
7. Measure how far the elastic band stretched before the box or basket moved. Record this distance.
8. Repeat this two more times, recording the distance you can calculate the average distance. (You can leave this step out if it is too difficult.)
9. Change the surface being tested and repeat steps 4–8.

Scientific Inquiry

How much force is required to overcome static friction?

Learning Intention

We can create a force that will overcome friction.

Equipment

- Rubber box or basket (or one made from any non-slip material)
- Rubber band
- Measuring tape or one metre ruler
- Weight to add to the box or basket, if necessary
- Possible surfaces to be tested: wooden floor, carpet, lino, tiles, tarmac, grass (think about the materials they are made of when you are selecting). You can find most of these type of materials in sample form which would allow all the testing to take place in one area.
- Water or oil spray (for extension activity)

Discussion

Ask the learners:

- How hard did we have to pull to move the box or basket on each surface?
- Which surface was the easiest? Was it smooth or rough?
- Which surface was the hardest? Was it smooth or rough?
- Do smooth or rough surfaces make the most friction?

Extension

Ask the learners:
'Does it change the results/measurements if you add water or oil to the surface?'

Create a sheet of ice in a tray and test it.

What happens if you test a box or basket or other object made from a different material?